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NOT MEASUREMENT
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MIL-PRF-29602A

SUPERSEDING

MIL-C-29602

28 February 1995

PERFORMANCE SPECIFICATION

CLEANING COMPOUND, PARTS WASHER AND SPRAY CABINET

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers two types of cleaning compound used in parts washers and spray cabinets for cleaning aircraft components.

1.2 Classification. The cleaning compound covered by this specification is classified as follows:

Type I - Water soluble liquid concentrate

Type II - Water soluble powder

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6850

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2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

CCC-C-46 - Cloth, Cleaning, Nonwoven Fabric. (Inactive for new design)

DEPARTMENT OF DEFENSE

MIL-S-7952 - Steel, Sheet and Strip, Uncoated, Carbon (1020 and 1025)
(Aircraft Quality)
MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys
MIL-G-21164 - Grease, Molybdenum Disulfide for Low and High Temperatures,
NATO Code Number G-353
MIL-PRF-23699 - Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
Ultra-Thin Film
MIL-PRF-83282 - Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base,
Aircraft, Metric, NATO Code Number H-537
MIL-DTL-83488 - Coating, Aluminum, High Purity
DOD-L-85734 - Lubricating Oil, Helicopter Transmission System, Synthetic Base

(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation (see 6.2).

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR - Protection of the Environment

(Copies of this document are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-0001.)

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-A240	-	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels, Standard Specification for (DoD adopted)
ASTM-B152	-	Copper Sheet, Strip, Plate, and Rolled Bar, Standard Specification for (DoD adopted)
ASTM-D93	-	Flash-Point by Pensky-Martens Closed Cup Tester, Standard Test Methods for (DoD adopted)
ASTM-D95	-	Water in Petroleum Products and Bituminous Materials by Distillation, Standard Test Method for (DoD adopted)
ASTM-D2834	-	Nonvolatile Matter (Total Solids) in Water-Emulsion Floor Polishes, Solvent-Based Floor Polishes, and Polymer-Emulsion Floor Polishes, Standard Test Method for
ASTM-E70	-	pH of Aqueous Solutions with the Glass Electrode, Standard Test Method for (DoD adopted)
ASTM-F483	-	Total Immersion Corrosion Test for Aircraft Maintenance Chemicals
ASTM-F519	-	Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments, Standard Test Method for. (DoD adopted)
ASTM-F945	-	Stress-Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials, Standard Test Method for
ASTM-F1110	-	Sandwich Corrosion Test, Standard Test Method for (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE-AMS-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet
SAE-AMS2470	-	Anodic Treatment of Aluminum Alloys, Chromic Acid Process. (DoD adopted)

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SAE-AMS4375	-	Sheet and Plate, Magnesium Alloy, 3.0Al - 1.0Zn - 0.20Mn (AZ31B-0), Annealed and Recrystallized. (DoD adopted)
SAE-AMS5040	-	Steel, Sheet and Strip, 0.15 Carbon, Maximum, Deep Forming Grade. (DoD adopted)
SAE-AMS5046	-	Sheet Strip and Plate, Carbon Steel (SAE 1020 and 1025), Annealed
SAE-AMS-QQ-P-416	-	Plating, Cadmium
SAE-AMS-T-9046	-	Titanium and Titanium Alloy, Sheet, Strip and Plate
SAE-AMS5536	-	Nickel Alloy, Corrosion and Heat Resistant, Sheet, Strip, and Plate, 47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe, Solution Heat Treated. (DoD adopted)

(Application for copies should be addressed to the Society of Automotive Engineers International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The cleaning compound furnished under this specification shall be a product that is authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.3).

3.2 Materials. The cleaning compound shall not contain known or suspected carcinogens, ozone depleting substances, hazardous air pollutants, volatile organic compounds, or Total Toxic Organic (TTO) compounds as defined in 40 CFR. Surface-active agents used in the cleaning compound shall be not less than 85 percent biodegradable when determined in accordance with methods appropriate to surface-active agent type.

3.3 Unit of issue. To interface with existing equipment and meet the required storage characteristics, the cleaning compound shall be furnished in 5-, 15-, or 55-gallon metal containers lined with an inert plastic such as polyethylene.

3.4 Markings. Markings to identify type I and type II cleaning compounds and to indicate that the product should not be used at full strength shall appear on each container.

3.5 Performance requirements.

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3.5.1 Biodegradability. The supplier of the cleaning compound shall ensure that the surfactants used in the cleaning compound are biodegradable in accordance with 40 CFR, Part 796, subpart D. Testing for biodegradability shall be in accordance with 4.5.1. The cleaning compound shall meet the requirement of not less than 85 percent biodegradable at the end of the 28 day period specified in 4.5.1.

3.5.2 Flash point. The Pensky-Martens flash point of the concentrated cleaning compound shall be greater than 212 °F (100 °C) when tested in accordance with 4.3.

3.5.3 pH. The pH of the cleaning compound shall be no less than 10 and no greater than 13.5, when run at the manufacturer's recommended cleaning concentration and in accordance with 4.3.

3.5.4. Foaming characteristics. At the manufacturer's recommended concentration, the cleaning compound shall produce a foam volume of not more than 100 ml, when tested at 120 °F (49 °C) and 160 °F (71 °C) in accordance with 4.5.2.

3.5.5 Corrosivity.

3.5.5.1 Sandwich corrosion. The cleaning compound shall not cause a corrosion rating greater than one nor shall it cause more corrosion than deionized water, when tested at the manufacturer's recommended concentration and in accordance with 4.3.

3.5.5.2 Titanium stress corrosion. The cleaning compound shall not produce any microscopic cracking when tested at the manufacturer's recommended concentration and examined metallographically at 500X magnification (see 4.3).

3.5.5.3 Total immersion corrosion. The cleaning compound shall cause neither visual corrosion nor an average weight change of any specimen greater than that shown in table I, when tested at the manufacturer's recommended concentration and in accordance with 4.5.3.

Table I. Total immersion corrosion weight changes.

Test panel material	Allowable weight change (mg/cm ² /24 hours)
Aluminum (SAE-AMS-A-250/4)	0.04
Aluminum (SAE-AMS-A-250/4) anodized per MIL-A-8625, type I	0.04*
Carbon steel (SAE-AMS5046)	0.04
Copper (ASTM-B152)	0.10
Magnesium (AMS 4375)	0.20
Nickel (SAE-AMS-5536)	0.04

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Stainless steel (ASTM-A240, Class 410)	0.04
Carbon steel (SAE-AMS5046) plated per SAE-AMS-QQ-P-416, Type I	0.20
Titanium (AMS-T-9046, type III, comp C)	0.04

* Weight increase of more than 0.04 is allowable if no white corrosion products are evident.

3.5.5.4 Hydrogen embrittlement. When tested at the manufacturer's recommended concentration in accordance with 4.5.4, neither cadmium plated AISI 4340 steel specimens nor IVD aluminum coated AISI 4340 steel specimens shall exhibit embrittlement. Failure is indicated if a specimen fractures in less than 200 hours or, for the alternate procedure, if a specimen fractures at less than 85 percent of the notch fracture strength.

3.6 Stability.

3.6.1 Hard water stability. When tested at the manufacturer's recommended concentration and as specified in 4.5.5, the cleaning compound shall not cause any corrosion of SAE-AMS-A-250/4 aluminum in excess of that allowed in table I.

3.6.2 Storage stability. When tested as specified in 4.5.6 and after a 6 month storage period, the cleaning compound shall not exhibit any separation, crystallization or other deterioration of the cleaning compound or container. The immersed steel strip shall not exhibit any visual corrosion. Stored cleaning compound shall not fail the sandwich corrosion test of 3.5.5.1 on bare or anodized aluminum alloy.

3.6.3 Accelerated storage stability. After tested for accelerated storage as specified in 4.5.7, the test sample shall show no marked change in color or uniformity when compared to the control, nor shall it pit, corrode or cause uneven darkening of steel surfaces; and shall have a soil removal value not less than 95 percent of that which is obtained with unaged cleaning compound.

3.7 Cleaning efficiency. The cleaning compound shall remove at least 70 percent of unbaked grease in accordance with MIL-G-21164 and at least 95 percent of baked Alox 2028, when tested at the manufacturer's recommended concentration as specified in 4.5.8.

3.8 Oil separation. The oil layer shall be no less than 9 and no more than 13 milliliters, when tested as specified in 4.5.9.

3.9 Workmanship. When examined visually at room temperature, the type I cleaning compound shall be a homogeneous liquid free of foreign matter. A faint turbidity shall not be cause for rejection.

3.10 Service evaluation. Upon completion of all other tests herein, with the exception of storage stability (see 3.6.2), the qualifying activity shall request a full evaluation of the cleaning compound by an aircraft depot maintenance facility (Navy, Air Force, Army, or commercial) in accordance with 4.5.10. The cleaning compound performance shall be equal to or better than an existing qualified product chosen by the maintenance facility.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with standard conditions. Standard conditions shall be a temperature of 72 ± 4 °F (22 ± 2 °C) and a relative humidity of 50 ± 20 percent.

4.3 Qualification inspections. Qualification inspection shall consist of all the tests specified in table II. At the discretion of the qualifying activity, service evaluation of the cleaning compound may be required.

TABLE II. Qualification inspection.

Characteristic	Requirement paragraph	Test method or paragraph
Biodegradability	3.5.1	4.5.1
Nonvolatile content (type I) <u>1/</u>	--	ASTM-D2834
Water content (type II)	--	ASTM-D95
Flash point	3.5.2	ASTM-D93
pH	3.5.3	ASTM-E70
Foaming	3.5.4	4.5.2
Sandwich corrosion	3.5.5.1	ASTM-F1110
Titanium stress corrosion <u>2/</u>	3.5.5.2	ASTM-F945
Total immersion corrosion <u>3/</u>	3.5.5.3	SAE-ARP1755
Hydrogen embrittlement <u>4/</u>	3.5.5.4	ASTM-F519
Hard water stability	3.6.1	4.5.5
Storage stability	3.6.2	4.5.6
Accelerated storage stability	3.6.3	4.5.7
Cleaning efficiency	3.7	4.5.8
Oil separation	3.8	4.5.9
Workmanship (type I)	3.9	Visual examination

1/ Nonvolatile content shall be determined using 2- to 3-gram sample weights, 100-mm diameter glass Petri dishes, and a forced draft oven at 221 ± 4 °F (105 ± 2 °C) for 16 hours.

2/ At 500X magnification

3/ As modified in 4.5.3

4/ As modified in 4.5.4

4.3.1 Samples. Qualification test samples shall consist of two 1-gallon plastic containers of cleaning compound of the type for which qualification is desired. The samples shall be furnished in units of issue as specified in 3.3.

4.4 Conformance inspection. The cleaning compound acquired by the Government under this specification shall be source inspected in accordance with 4.4.2 to ensure the material meets the conformance inspection prior to shipment from the manufacturer's plant.

4.4.1 Sampling. Two containers of cleaning compound shall be randomly selected from each lot and tested as specified in 4.4.2.

4.4.2 Testing. Samples selected in accordance with 4.4.1 shall be tested in accordance with the test methods specified in table III. Each sample selected shall be thoroughly mixed prior to testing. Failure of either sample to conform to any requirement specified in section 3 shall be cause for rejection of the lot represented by these samples.

TABLE III. Conformance inspection.

Inspection	Requirement paragraph	Test method or paragraph
Nonvolatile content (type I) <u>1/</u>	3.2	ASTM-D2834
Water content (type II)	--	ASTM-D95
Flash point	3.5.2	ASTM-D93
pH	3.5.3	ASTM-E70
Foaming	3.5.4	4.5.2
Total immersion corrosion <u>2/</u>	3.5.5.3	ASTM-F483
Sandwich corrosion	3.5.5.1	ASTM-F1110
Titanium stress corrosion	3.5.5.2	ASTM-F945

1/ Nonvolatile content shall be determined using 2- to 3-gram sample weights, 100-mm diameter glass Petri dishes, and a forced draft oven at 221 ± 4 °F (105 ± 2 °C) for 16 hours.

2/ As modified in 4.5.3.

4.5 Methods of inspection.

4.5.1 Biodegradability. Biodegradation of the concentrated cleaning compound shall be determined over 28 days by the "Shake Flask Biodegradation Tests" for measuring ultimate or ready degradation potential, monitored by analysis of Total Organic Carbon (TOC), as found in EPA

Chemical Fate Test Guidelines 40 CFR, Method 796.3100 (Aerobic Aquatic Biodegradation Test) or 40 CFR, Method 796.3240 (OECD Screening Test for Ready Biodegradability). Biodegradability shall be shown as carbon transformation by both soluble organic carbon reduction and CO₂ evolution.

4.5.2 Foaming. One hundred milliliters (ml) of cleaning compound, diluted to the manufacturer's recommended cleaning concentration, shall be placed in a blender container and conditioned at 160 ± 2 °F (71 ± 1 °C) for 1 hour. The blender shall then be turned on for 2 minutes at 8000 ± 1000 rotations per minute. After 2 minutes, the blender shall be turned off and the foam volume shall be determined immediately by reading a graduated scale on the blender container. The test shall be repeated at 120 ± 2 °F (49 ± 1 °C).

4.5.3 Total immersion corrosion. The cleaning compounds shall be diluted to the manufacturer's recommended cleaning concentration. Corrosion specimens that are not plated, anodized, or conversion coated shall be polished with 240-grit aluminum oxide or silicon carbide paper or cloth. Specimens shall be cleaned and exposed as specified in ASTM-F483, except that the cleaning solution shall be heated to 160 ± 2 °F (71 ± 1 °C) prior to and during the test. After 24 hours, the panels shall be removed, cleaned, and weighed in accordance to ASTM-F483.

4.5.4 Hydrogen embrittlement. Hydrogen embrittlement shall be determined in accordance with ASTM-F519, using AISI 4340, type 1a or 1e specimens.

4.5.4.1 Specimen coating. Cadmium plated specimens shall be prepared as specified using treatment B, without conversion coating. Ion vapor deposited (IVD) aluminum specimens shall be prepared in accordance with MIL-DTL-83488, class 2, type II. Plating and IVD shall cover the notch and surfaces within 0.5 inch of the notch; threaded surfaces shall not be plated. Cadmium-plated specimens shall be baked in accordance with ASTM-F519.

4.5.4.2 Procedure. Each specimen shall be masked so that only plated or IVD surfaces are exposed. Four specimens for each coating shall be individually exposed, immediately dried, then immediately tested for embrittlement. Exposure shall consist of immersion in a glass beaker containing fresh cleaning solution (at the manufacturer's recommended concentration) at 160 ± 2 °F (71 ± 1 °C) for one hour. Specimens shall be dried without rinsing at ambient conditions for five minutes. Embrittlement testing shall consist of applying a load equivalent to 45 percent of notch fracture strength for 200 hours; alternately, a load equivalent to 45 percent of notch fracture strength shall be applied for 24 hours, then stepped an additional 5 percent each hour until failure. Failure shall be as indicated in 3.5.5.4.

4.5.5 Hard water stability.

4.5.5.1 Preparation of stock solution. Forty ml of synthetic hard water (0.20 gram calcium acetate monohydrate and 0.14 gram magnesium sulfate heptahydrate diluted to 1 liter with distilled water) shall be added to 10 ml of concentrated cleaning compound in a 50-ml graduated cylinder. The solution shall be shaken vigorously for 15 seconds and allowed to stand undisturbed at 72 ± 4 °F (22

± 2 °C) for 16 hours. A 10-grain hard water stock solution shall be prepared by dissolving 0.20 ± 0.005 gram of analytical reagent grade calcium acetate, $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$, and 0.14 ± 0.005 gram of analytical reagent grade magnesium sulfate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, in one liter of boiled distilled water.

4.5.5.2 Procedure. In a 250 ml polymethylpentene (PMP) container, dilute the cleaner concentrate with the prepared stock solution to achieve the manufacturer's recommended concentration. Shake the container vigorously for 15 seconds, place in a 160 °F (71 °C) oven for two hours, then allow to stand undisturbed for 16 hours at room temperature. Test the filtrate for corrosivity on SAE-AMS-A-250/4 aluminum test panels as specified in 4.5.3.

4.5.6 Storage stability. One gallon of cleaning compound as furnished by the manufacturer in its high-density polyethylene container shall be prepared for storage stability testing by adding a steel strip. The strip, 150 by 12.5 by 0.5 mm conforming to SAE-AMS-5046, shall be polished with 280 grit silicon carbide paper and cleaned by wiping with reagent grade acetone, reagent grade isopropyl alcohol, then wiping dry (each time using bleached cotton cheesecloth or CCC-C-46, Class 7 wipes). After 6 months of storage at 70 ± 5 °F (21 ± 3 °C), the cleaning compound shall be examined for evidence of separation, crystallization or other deterioration of the cleaning compound or of the container. In addition, the steel strip shall be examined for evidence of corrosion. And finally, a sample of the stored cleaning compound shall be used to perform the sandwich corrosion test on bare and anodized aluminum alloy.

4.5.7 Accelerated storage stability.

4.5.7.1 Preparation of test sample. A 150-ml portion of well-shaken concentrated cleaning compound shall be poured into each of two chemically clean 500 ml clear, round, screw cap plastic bottles with an outside diameter of approximately 2.5 inches. One bottle shall be immediately capped and stored in the dark at room temperature for a minimum of 6 days (control sample). A strip of steel, conforming to MIL-S-7952 and measuring 150 by 12.5 by 0.5 mm, shall be polished with 280 grit silicon carbide paper to remove surface contamination and then cleaned by boiling in chemically pure isopropyl alcohol for one minute and in mineral spirits for one minute. The steel strip shall be placed in the second bottle and the bottle shall be immediately capped (test sample) and thoroughly shaken for one minute.

4.5.7.2 Procedure. The test sample shall be placed in a water bath heated to 100 ± 4 °F (39 ± 2 °C) and held at that temperature for not less than 8 hours. The bath shall then be cooled to room temperature over the next 16 hours. This procedure shall be repeated every day for 5 additional days. After exposure for a total of 6 cycles, the test sample shall be removed from the bath and visually examined for separation of the cleaning compound. The test sample shall then be uncapped, the steel strip carefully removed and examined for evidence of pitting, corrosion, or uneven darkening. The test sample shall be recapped and, along with the control sample, thoroughly shaken for 1 minute, allowed to stand undisturbed at room temperature for a minimum of 1 hour, then be compared

to the control sample. When the test sample is in compliance with the visual requirements, it shall be tested for cleaning efficiency (see 4.5.8) for conformance to the requirements of this specification.

4.5.8 Cleaning efficiency. The cleaning compound solution shall be prepared by diluting the concentrated cleaning compound to the manufacturer's recommended cleaning concentration with synthetic hard water (see 4.5.5.1).

4.5.8.1 MIL-G-21164 grease. Molybdenum disulfide grease soil shall be prepared by blending 50 grams of Raven 1040 carbon black (Columbia Carbon Company or equal) and 500 grams of grease in accordance with MIL-G-21164 with a mechanical grease worker for 15 minutes.

4.5.8.2 Alox 2028. Alox 2028 (available from Alox Corporation, Niagara Falls, NY) shall be used as a soil, as received.

4.5.8.3 Test coupons. Test coupons shall be aluminum or stainless steel 0.25 by 1.0 by 4.0 inches with a 0.0625 inch deep rectangular depression 0.75 by 2.75 inches, located 0.375 inches from one end. Prior to a soil application, coupons shall be cleaned, dried, baked at 221 ± 5 °F (105 ± 2 °C) for 5 minutes, cooled, and weighed to the nearest 0.1 mg (W_1). The coupons shall be solvent wiped with acetone (dimethylketone) using wipes in accordance with CCC-C-46, class 7. The pre-cleaning shall continue until the wipe is free of visual residue. The coupons shall be dried in an oven at 221 ± 4 °F (105 ± 2 °C) for 30 minutes. The coupons shall then be removed from the oven, air-cooled to room temperature, and weighed to the nearest 0.1 mg (W_1).

4.5.8.4 Apparatus. The cleaning apparatus shall consist of a 600 ml beaker, heavy duty glass beaker, a 2 inch long by 0.375 inch diameter cylindrical magnetic stirring bar, a test coupon, and a digital stirrer/hot plate with speed and temperature control.

4.5.8.5 Soil removal. Test panels shall be loaded (using a clean acid brush) by brushing the bottom of the depression with a test soil to give a uniform film. Following the conditioning in table IV, the panels shall be weighed (W_2). Use only test panels with soil weights between 100 and 150 mg. Prepare the cleaning solution by diluting the cleaning compound to the manufacturer's recommended concentration using synthetic hard water as described in 4.5.5.1. Add 500 ml of the cleaning solution and stirring bar to the beaker and stabilize at 160 ± 5 °F (71 ± 1 °C) using the stirrer/hot plate. Clamp the 3 panels to the side of the beaker so that the soiled depression is fully immersed. Set the stirring speed at 500 rpm and continue stirring for 10 minutes. Rinse the specimen as indicated in table IV.

Soils shall be cleaned sequentially in the same prepared solution, with coupons soiled in MIL-G-21164 grease followed by coupons soiled with Alox 2028.

TABLE IV. Conditioning and rinsing.

SOIL	CONDITIONING	RINSING
Alox 2028	1 hour at 221 °F (105 °C); Air-cool to room temperature	Pour the solution from the beaker and immediately place the beaker with coupon under flowing cold tap water for one minute without impinging on the soiled area.
MIL-G-21164	None	Remove the test coupon from the beaker and immediately rinse under a 4-liter/min water stream from a laboratory faucet with serrated tip (test coupon shall be 10-12 inches from the tip and held at 45° to the stream)

Dry the coupon for 5 minutes at 105 ± 2 °C (221 ± 5 °F), cool and weigh (W_3). The cleaning efficiency result for each of the two soils shall be an average of three test panels. Calculate panel cleaning efficiency (CE) as follows:

$$CE (\%) = (W_2 - W_3) / (W_2 - W_1) \times 100$$

4.5.9 Oil separation. Prepare a 100 ml sample of the manufacturer's recommended concentration of the cleaning compound in a 100 ml graduated cylinder. Discard 10 ml of the solution and replace it with 10 ml of hydraulic fluid in accordance with MIL-PRF-83282. Place the cylinder in a forced convection oven at 160 °F (71 °C) for one hour. Remove the cylinder from the oven, shake it vigorously for 10 seconds, and allow it to stand at room temperature for one hour. After one hour, observe and record the volume of the top (oil) layer.

4.5.10 Service test. Service testing shall be performed at a military aviation depot using an automated parts washer on soiled parts which are typical of those cleaned at the depot. Alternatively, artificially soiled parts may be prepared using fluids normally encountered in service to coat clean parts. In either case, results for the product being tested shall be compared to the results for a product which is already qualified to this specification.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging

requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The cleaning compounds covered by this specification are used in the maintenance of military aircraft exposed for prolonged periods to extreme seagoing environments not encountered by civilian aircraft. The cleaning compound is intended for use in parts washers and spray cabinets for cleaning aviation weapons systems, and engine and support equipment components. The cleaning compound will remove oily contaminants which are present on disassembled components.

6.1.1 Solution test kit use. The following test kit components and procedures can be used to maintain the cleaning solutions by replenishment with the concentrated cleaning compound:

- 25 ml measuring vial
- 5 ml measuring vial
- 50 ml chemical resistant plastic flask
- 25 ml dropper bottle of 0.5 percent phenolphthalein indicator
- 100 ml dropper bottle of 1.0 N sulfuric acid.

6.1.1.2 Procedure. This procedure requires the user to make a chart for the product being used, if one has not been made previously. Together with the titration results for the tank solution in question, this chart will determine the amount of cleaner concentrate to be added to the tank.

6.1.1.2.1 Chart. Make up the manufacturer's recommended concentration and make sure it is well dissolved. Take the appropriate sample size (20 ml for a liquid and 5 ml for a powder), add it to the flask, then add 6 drops of indicator. Add the sulfuric acid solution a drop at a time, swirling the mixture after each drop. Count the number of drops it takes until the pink color is completely gone (use a sheet of white paper under the flask to help see the color). Repeat this procedure to make sure that you have done this correctly. Divide the concentration (in ounces per gallon) by the number of drops -- this is the first line for your chart and is the concentration corresponding to 1 drop of acid. Two drops would correspond with twice that concentration. Three drops with three times that concentration, and so on.

6.1.1.2.2 Determining the concentration of the cleaner solution. Take a sample of the cleaning solution: 20 ml for a type I solution or 5 ml for a type II solution. Pour the sample into a clean 50 ml plastic flask. Add 6 drops of indicator to the flask and swirl to mix. The solution will be a pink or red pink color. Add the sulfuric acid solution a drop at a time, swirling the mixture after each drop. Count the number of drops it takes until the pink color is completely gone. Use the chart described in 6.1.1.2.1 to determine the concentration of the sample.

6.1.1.2.3 Determine the amount of cleaner concentrate to add. Suppose the parts washer has a 150 gallon tank of cleaning solution made up using a Type I product designed to be used at 7.5 oz/gal (fluid ounces per gallon). You would use the larger vial to take a 20 ml sample from the tank. After pouring that sample into the flask and adding the correct amount of indicator, you find that it takes a certain number drops of acid to cause the color to change. From the chart, you find that number of drops indicates the cleaner concentration in the parts washer is 5.0 ounces per gallon (oz/gal). If you want to bring the concentration back up to 7.5 oz/gal, you need to calculate the makeup volume of cleaner to add to the tank. Subtract the indicated concentration from the desired concentration then multiply by the volume of the tank:

$$\text{Volume} = (7.5 - 5.0) \text{ oz/gal} \times 150 \text{ gal} = 375 \text{ oz (or 2.9 gal)}$$

This is the volume of cleaner concentrate that must be added to the tank. If the total of all makeup additions is more than the amount of cleaner initially charged to the tank, the tank should be dumped, cleaned and recharged with fresh cleaner and water.”

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type of cleaning compound required (see 1.2).
- c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3).
- d. Unit of issue required (see 3.3).
- e. Quantity required.
- f. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-29602 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for products covered by this specification. Information pertaining to qualification of products may be obtained from the Naval Air Warfare Center

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Aircraft Division, Code 4.3.4.1, Building 2188, 22347 Cedar Point Road, Unit 6, Patuxent River, MD 20670-1161.

6.3.1 Inspection reports and additional information. When authorizing the forwarding of qualification samples, the qualifying activity will require the manufacturer to submit, along with the samples, the following data:

- a. Two copies of the manufacturer's test report containing complete test data showing that the material submitted for qualification conforms to the requirements of this specification.
- b. Certification that the cleaning compound contains no carcinogens, ozone depleting substances, hazardous air pollutants, volatile organic compounds, or Total Toxic Organic and is biodegradable (see 3.2).
- c. Material safety data sheets prepared in accordance with FED-STD-313 (see 6.5.1).
- d. Two copies of the manufacturer's instructions for use of the cleaning compound.
- e. A proven method for determining and maintaining the proper concentration of cleaning compound in the parts washer.

The samples must be plainly and durably marked with the following information and forwarded to the test facility identified in the letter of authorization to submit samples:

- Sample for qualification inspection
- CLEANING COMPOUND, PARTS WASHERS AND SPRAY CABINETS
- Specification MIL-PRF-29602A
- Type I or II, as applicable
- Manufacturer's name and address
- Manufacturer's product identification
- Manufacturer's recommended dilution
- Batch number
- Date of manufacture
- Submitted by (name and date) for qualification inspection in accordance with the requirements of MIL-PRF-29602A under authorization of (reference authorization letter).

6.4 Supplier information.

Table V. Item supplier information.

Item	Identification	Supplier	Location
Measuring vial, 25 ml	Cat. No. 2172-40	Hach Company	P. O. Box 389 Loveland, CO 80539 (800) 227-4224
Measuring vial, 5 ml	Cat. No. 2172-38		
Plastic flask, chemical resistant, 50 ml	Cat. No. 20898-71		

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Dropper bottle of 0.5% phenolphthalein indicator, 25 ml	Cat. No. 162-36		
Dropper bottle of 1.0 N sulfuric acid, 100 ml	Cat. No. 1270-26		

6.5 Retention of qualification. To retain qualification of the products approved for listing on the QPL, the manufacturer will verify by certification to the qualifying activity that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification will be every two years from the date of original qualification and will be initiated by the Government. The Government reserves the right to re-examine the qualified product whenever deemed necessary to ensure that the product continues to meet any or all of the specification requirements.

6.6 Lot formation. Unless otherwise specified, a lot consists of all the cleaning compound produced by one manufacturer, at one plant, from the same materials and under essentially the same conditions, provided the operation is continuous and does not exceed a 24 hour period. In the event the process is a batch operation, each batch will constitute a lot.

6.7 Toxicity. The cleaning compound, when used for its intended purpose, must have no adverse effect on the health of personnel. Questions pertaining to this effect will be referred by the acquiring activity to the appropriate medical service who will act as an adviser to the contracting agency.

6.8 Material Safety Data Sheets (MSDSs). MSDSs for items supplied to the Government will conform to FED-STD-313, Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

6.9 Subject term (key word) listing.

Aqueous
Biodegradable
Dilutable
Dimethylketone
Service evaluation

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:

Preparing activity:

MIL-PRF-29602A

Army - EA

Navy - AS

Air Force - 68

Navy - AS

(Project 6850-1246)